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## 7-1/2 Digit Graphical Sampling Multimeter Specifications

### SPECIFICATION CONDITIONS

This document contains specifications and supplemental information for the Model DMM7512 7-1/2 Digit Graphical Sampling Multimeter instrument. Specifications are the standards against which the DMM7512 is tested. Upon leaving the factory, the DMM7512 meets these specifications. Supplemental and typical values are nonwarranted, apply at 23 °C, and are provided solely as useful information.

Measurement accuracies are specified at the DMM7512 terminals under these conditions:

- Temperature 23 °C ±5 °C, 5% to 80% relative humidity, noncondensing
- After a 90-minute warmup period
- 1 PLC or 5 PLC measurement rate; for NPLC settings less than 1 PLC, add appropriate ppm of range for peak noise uncertainty from the [RMS noise table](#)
- Autozero enabled unless otherwise noted
- Remote sense operation or properly zeroed local operation
- Calibration period: One year or two years (calibration period may vary depending on customer requirements)

Definitions:

- $T_{ACAL}$ : Ambient temperature of last automatic calibration
- $T_{CAL}$ : Ambient temperature of last external calibration; factory calibration performed at 23 °C ±1 °C

### DC VOLTAGE

#### ACCURACY (INPUT IMPEDANCE AUTO)

Range <sup>1</sup>	Resolution	Input impedance	Accuracy ±[ppm of reading + ppm of range]				
			24 hour $T_{CAL} \pm 1 \text{ }^\circ\text{C}^2$	90 day $T_{CAL} \pm 5 \text{ }^\circ\text{C}$	1 year $T_{CAL} \pm 5 \text{ }^\circ\text{C}$	2 year $T_{CAL} \pm 5 \text{ }^\circ\text{C}$	Temperature coefficient <sup>3</sup>
100 mV <sup>4</sup>	10 nV	> 10 GΩ or 10 MΩ ±1%	6 + 30	12 + 30	18 + 30	29 + 30	0.1 + 2.5
1 V <sup>4</sup>	100 nV	> 10 GΩ or 10 MΩ ±1%	4 + 2	9 + 5	15 + 5	26 + 5	0.1 + 0.5
10 V <sup>4</sup>	1 μV	> 10 GΩ or 10 MΩ ±1%	2 + 0.7	9 + 1.2	14 + 1.2	22 + 1.2	0.1 + 0.05
100 V <sup>4</sup>	10 μV	10 MΩ ±1%	8 + 6	[18 + 5] <sup>5</sup>	[22 + 15] <sup>5</sup>	[30 + 15] <sup>5</sup>	[0.15 + 0.01] <sup>5</sup>
				35 + 15	40 + 15	45 + 15	2.0 + 1
1000 V <sup>4, 6</sup>	100 μV	10 MΩ ±1%	8 + 6	[19 + 10] <sup>5</sup>	[23 + 10] <sup>5</sup>	[31 + 10] <sup>5</sup>	[0.15 + 0.01] <sup>5</sup>
				35 + 10	40 + 10	45 + 8	2.0 + 1

<sup>1</sup> 20% overrange on all ranges except 1% for 1000 V range.

<sup>2</sup> Relative to calibration accuracy.

Specifications are subject to change without notice.



**RMS NOISE (ADDITIONAL PEAK NOISE UNCERTAINTY)<sup>7</sup>**

- Applies to ± ppm of range
- Peak noise uncertainty is included in dc specifications for ≥ 1 PLC
- Add peak noise uncertainty to measurements for < 1 PLC
- Input impedance set to auto

**Examples:**

- 10 V at 0.006 PLC: 1.2 (from Accuracy table) + 11 (additional peak noise uncertainty) = 12.2 ppm of range
- 10 V at 1 PLC: 1.2 + 0 = 1.2 ppm of range

NPLC	Digits	100 mV	1 V	10 V	100 V	1000 V
5	7½	0.83	0.09	0.07	0.41	0.07
1	7½	0.73	0.13	0.09	0.56	0.10
0.2 <sup>8</sup>	6½	2.51 (10)	0.28 (1.6)	0.17 (1.1)	1.45 (9.4)	0.20 (1)
0.2	6½	3.16 (12)	0.34 (1.6)	0.18 (1)	1.42 (8.9)	0.20 (1.1)
0.06	5½	4.09 (17)	0.53 (2.7)	0.38 (2.1)	3.41 (17)	0.47 (2.4)
0.006	4½	19 (95)	3.80 (18)	3 (15)	34 (125)	3.98 (18)
0.0005	3½	95 (480)	48 (215)	36 (170)	173 (800)	40.63 (205)

**DC VOLTAGE CHARACTERISTICS**

<b>ADC linearity</b>	1.0 ppm of reading + 1.0 ppm of range
<b>Input impedance</b>	100 mV to 10 V ranges: Selectable > 10 GΩ    < 400 pF (auto) or 10 MΩ ±1% (10 MΩ) 100 V to 1000 V ranges: 10 MΩ ±1%
<b>Input bias current</b>	< 50 pA at 23 °C under the following conditions: Autozero off or input impedance 10 MΩ
<b>Common mode current</b>	< 2.1 µA peak-peak in 1 MHz bandwidth < 100 nA peak-peak in 1 kHz bandwidth
<b>Common mode voltage</b>	500 V <sub>PEAK</sub> LO terminal to chassis maximum
<b>Autozero off error, dc voltage</b>	For ±1 °C and ≤ 10 minutes, add ± (8 ppm of reading + 15 µV)

**NORMAL MODE REJECTION**

For dc voltage, line frequency ±0.1%

	5 PLC	1 PLC	≤ 0.2 PLC	≤ 0.01 PLC
<b>Line sync on</b>	110 dB	90 dB	45 dB	—
<b>Line sync off</b>	60 dB	60 dB	—	—

<sup>3</sup> Add per degree from T<sub>CAL</sub> ± 5 °C.

<sup>4</sup> When properly zeroed using the Rel function with external cables.

<sup>5</sup> Specified within 30 days of autocalibration, T<sub>OPER</sub> ± 5 °C from T<sub>ACAL</sub>.

<sup>6</sup> For signal levels greater than 500 V, add 0.02 ppm/V to the ppm of the readings specification for measurements exceeding 500 V.

<sup>7</sup> Noise values are based on 1000 readings with autozero on and using low thermal 4-wire short. V<sub>RMS</sub> noise is typical. Additional peak noise is guaranteed.

<sup>8</sup> With line sync on.

Specifications and characteristics are subject to change without notice.

**COMMON MODE REJECTION**

For dc voltage and 1 kΩ unbalanced in LO terminal; ac CMRR is 70 dB

<b>NPLC</b>	<b>5</b>	<b>1</b>	<b>0.2</b>	<b>≤ 0.2</b>
<b>Line sync</b>	On	On	On	Off
<b>CMRR</b>	140 dB	140 dB	120 dB	80 dB

**RESISTANCE**

**ENHANCED ACCURACY (WITHIN 30 DAYS OF AUTOCALIBRATION, T<sub>OPER</sub> ± 5 °C FROM T<sub>ACAL</sub>)<sup>9</sup>**

Range <sup>10</sup>	Resolution	Test current <sup>11</sup> (± 5%)	Accuracy ±[ppm of reading + ppm of range]				
			24 hour T <sub>CAL</sub> ±1 °C <sup>12</sup>	90 day T <sub>CAL</sub> ±5 °C	1 year T <sub>CAL</sub> ±5 °C	2 year T <sub>CAL</sub> ±5 °C	Temperature coefficient <sup>13</sup>
1 Ω	0.1 μΩ	10 mA	15 + 60	30 + 60	30 + 60	30 + 60	0.15 + 0.1
10 Ω	1 μΩ	10 mA	15 + 6	30 + 6	30 + 6	30 + 6	0.15 + 0.1
100 Ω	10 μΩ	1 mA	12 + 4	27 + 4	27 + 4	27 + 4	0.15 + 0.1
1 kΩ	100 μΩ	1 mA	12 + 3	24 + 3	24 + 3	24 + 3	0.15 + 0.1
10 kΩ <sup>14</sup>	1 mΩ	100 μA	13 + 3	30 + 3	30 + 3	30 + 3	0.15 + 0.1
100 kΩ <sup>14, 15</sup>	10 mΩ	10 μA	13 + 3	30 + 3	30 + 3	30 + 3	0.3 + 0.1
1 MΩ <sup>14, 16</sup>	100 mΩ	10 μA	28 + 3	60 + 4	60 + 4	60 + 4	0.7 + 0.1
10 MΩ <sup>17</sup>	1 Ω	0.69 μA    10 MΩ	150 + 6	200 + 10	200 + 10	200 + 10	70 + 1
100 MΩ <sup>17</sup>	10 Ω	0.69 μA    10 MΩ	800 + 30	2000 + 30	2000 + 30	2000 + 30	385 + 1
1 GΩ <sup>17</sup>	100 Ω	0.69 μA    10 MΩ	9000 + 100	9000 + 100	9000 + 100	9000 + 100	3000 + 1

<sup>9</sup> Specifications are for 4-wire resistance, offset compensation on for ≤10 kΩ measurements, and offset compensation off for ≥10 kΩ measurements. 1 Ω range is 4-wire only. For 2-wire, with Rel, add 50 mΩ to ppm of range uncertainty. Without Rel and with Model 1756 test leads, add 100 mΩ to ppm of range uncertainty.

<sup>10</sup> 20% overrange on all ranges.

<sup>11</sup> Test current with offset compensation off.

<sup>12</sup> Relative to calibration accuracy.

<sup>13</sup> Add per degree from T<sub>CAL</sub> ±5 °C.

<sup>14</sup> Specifications are for external cable and load capacitance < 1 nF.

<sup>15</sup> For offset compensation on, add 10 ppm uncertainty to ppm of reading.

<sup>16</sup> For 4-wire 1 MΩ, open lead detector on, add 10 ppm uncertainty to ppm of reading.

<sup>17</sup> Specified for < 10% lead resistance mismatch in HI and LO.

Specifications are subject to change without notice.

**ACCURACY<sup>18</sup>**

Range <sup>19</sup>	Resolution	Test current <sup>20</sup> (±5%)	Accuracy ±[ppm of reading + ppm of range]				
			24 hour T <sub>CAL</sub> ±1 °C <sup>21</sup>	90 day T <sub>CAL</sub> ±5 °C	1 year T <sub>CAL</sub> ±5 °C	2 year T <sub>CAL</sub> ±5 °C	Temperature coefficient <sup>22</sup>
1 Ω	0.1 μΩ	10 mA	15 + 60	40 + 60	50 + 60	70 + 60	2.5 + 5
10 Ω	1 μΩ	10 mA	15 + 6	40 + 6	50 + 6	70 + 6	2.5 + 0.5
100 Ω	10 μΩ	1 mA	12 + 4	35 + 4	47 + 4	65 + 4	5 + 0.25
1 kΩ	100 μΩ	1 mA	12 + 3	30 + 3	41 + 3	65 + 3	5 + 0.25
10 kΩ <sup>23</sup>	1 mΩ	100 μA	10 + 3	30 + 3	42 + 3	65 + 3	2.5 + 0.25
100 kΩ <sup>23, 24</sup>	10 mΩ	10 μA	13 + 3	38 + 3	50 + 3	65 + 3	5 + 1
1 MΩ <sup>23, 25</sup>	100 mΩ	10 μA	28 + 3	75 + 5	100 + 5	130 + 5	5 + 1
10 MΩ <sup>26</sup>	1 Ω	0.69 μA    10 MΩ	150 + 6	200 + 10	400 + 10	600 + 12	70 + 1
100 MΩ <sup>26</sup>	10 Ω	0.69 μA    10 MΩ	800 + 30	2000 + 30	2000 + 30	2600 + 30	385 + 1
1 GΩ <sup>26</sup>	100 Ω	0.69 μA    10 MΩ	9000 + 200	9000 + 200	13000 + 200	14000 + 200	3000 + 1

**RESISTANCE OPEN CIRCUIT DC VOLTAGE<sup>27</sup>**

Range <sup>19</sup>	2-wire	Offset compensation off	Offset compensation on
		4-wire	4-wire
1 Ω	–	9.2 V	9.5 V
10 Ω	9.2 V	9.2 V	9.5 V
100 Ω, 1 kΩ	14.0 V	14.2 V	14.3 V
10 kΩ	9.5 V	9.5 V	9.5 V
100 kΩ, 1 MΩ	12.7 V	14.3 V	14.3 V (100 kΩ range only)
10 MΩ to 1 GΩ	6.9 V	6.9 V	–

<sup>18</sup> Specifications are for 4-wire resistance, offset compensation on for ≤10 kΩ measurements, and offset compensation off for ≥10 kΩ measurements. 1 Ω range is 4-wire only. For 2-wire, with Rel, add 50 mΩ to ppm of range uncertainty. Without Rel and with Model 1756 test leads, add 100 mΩ to ppm of range uncertainty.

<sup>19</sup> 20% overrange on all ranges.

<sup>20</sup> Test current with offset compensation off.

<sup>21</sup> Relative to calibration accuracy.

<sup>22</sup> Add per degree from T<sub>CAL</sub> ±5 °C.

<sup>23</sup> Specifications are for external cable and load capacitance < 1 nF.

<sup>24</sup> For offset compensation on, add 10 ppm of uncertainty to ppm of reading.

<sup>25</sup> For 4-wire, 1 MΩ, open lead detection on, add 10 ppm uncertainty to ppm of reading.

<sup>26</sup> Specified for < 10% lead resistance mismatch in HI and LO.

<sup>27</sup> Open circuit voltage is typical, measured from input HI to LO, SHI and SLO open. For 1 Ω to 1 MΩ ranges using an external digital multimeter (DMM) set to 10 MΩ input impedance; for 10 MΩ to 1 GΩ ranges, set external DMM to >10 GΩ input impedance.

Specifications and characteristics are subject to change without notice.

**4-WIRE OHMS (≤ 10 kΩ) OFFSET COMPENSATION ON**

**RMS NOISE (ADDITIONAL PEAK NOISE UNCERTAINTY)<sup>28</sup>**

- Applies to ± ppm of range
- Peak noise uncertainty is included in dc specifications for ≥ 1 PLC
- Add peak noise uncertainty to measurements for < 1 PLC

Examples

- 1 kΩ at 0.006 PLC: 3 (from Accuracy table) + 26 (additional peak noise uncertainty) = 29 ppm of range
- 1 kΩ at 1 PLC: 3 + 0 = 3 ppm of range

NPLC	Digits	1 Ω	10 Ω	100 Ω	1 kΩ	10 kΩ
5	7½	3.49	0.35	0.35	0.08	0.35
1	7½	7.81	0.79	0.79	0.14	0.78 (2)
0.2 <sup>29</sup>	6½	51.87 (160)	5.09 (13)	5.21 (13)	0.61 (2.6)	1.78 (8.2)
0.2	6½	68.32 (250)	6.76 (22)	6.80 (22)	0.85 (3.2)	1.78 (8.3)
0.06	5½	123.35 (546)	12.33 (54)	12.36 (56)	1.30 (6.6)	3.48 (18)
0.006	4½	397 (2144)	40 (252)	38 (216)	6 (34)	15 (78)
0.0005	3½	1767 (9333)	117 (933)	183 (954)	85 (406)	89 (456)

**2-WIRE OHMS**

**RMS NOISE (ADDITIONAL PEAK NOISE UNCERTAINTY)<sup>28</sup>**

- Applies to ± ppm of range
- Peak noise uncertainty is included in dc specifications for ≥ 1 PLC
- Add peak noise uncertainty to measurements for < 1 PLC

Examples:

- 10 kΩ at 0.006 PLC: 3 (from Accuracy table) + 5 (50 mΩ with Rel) + 43 (additional peak noise uncertainty) = 51 ppm of range
- 10 kΩ at 1 PLC: 3 + 5 + 0 = 8 ppm of range

NPLC	Digits	10 Ω	100 Ω	1 kΩ	10 kΩ
5	7½	1.35 (1.8)	0.89 (1.5)	0.15	0.26
1	7½	0.78	0.77 (0.4)	0.11	0.55 (0.45)
0.2 <sup>29</sup>	6½	2.75 (17)	2.82 (10)	0.30 (1.5)	1.27 (6.3)
0.2	6½	3.27 (17)	3.29 (14)	0.33 (1.6)	1.27 (6.4)
0.06	5½	5 (29)	6 (32)	0.6 (3.7)	2.38 (12)
0.006	4½	25 (150)	21 (119)	3.58 (21)	9.49 (50)
0.0005	3½	103 (517)	109 (536)	56 (219)	55 (283)

<sup>28</sup> Noise values are based on 1000 readings with autozero on and using low thermal 4-wire short. RMS noise is typical. Additional peak noise is guaranteed.

<sup>29</sup> With line sync on.

**RESISTANCE CHARACTERISTICS**

<b>Maximum 4-wire ohms lead resistance</b>	5 $\Omega$ per lead for 1 $\Omega$ range, 10% of range per lead for 10 $\Omega$ to 1 k $\Omega$ ranges; 1 k $\Omega$ per lead for all other ranges
<b>Offset compensation</b>	Selectable on 4-wire, 1 $\Omega$ to 100 k $\Omega$ ranges
<b>Open lead detector</b>	Default is off
<b>Autozero off error</b>	For 2-wire ohms, $\pm 1$ $^{\circ}\text{C}$ and $\leq 10$ minutes, add $\pm(8$ ppm of reading) and 1.5 m $\Omega$ for 10 $\Omega$ range, 15 m $\Omega$ for 100 $\Omega$ and 1 k $\Omega$ ranges, 150 m $\Omega$ for 10 k $\Omega$ range, 1.5 $\Omega$ for 100 k $\Omega$ range, and 15 $\Omega$ for all other ranges  For 4-wire ohms, $\pm 1$ $^{\circ}\text{C}$ and $\leq 10$ minutes, add $\pm(8$ ppm of reading)
<b>Input current limit</b>	For signals with a magnitude of +12 V to +40 V or -12 V to -40 V: $\pm 13$ mA source or sink, typical For signals with a magnitude of greater than +40 V or -40 V: $\pm 130$ $\mu\text{A}$ source or sink, typical

**DC CURRENT**
**ENHANCED ACCURACY (WITHIN 30 DAYS OF AUTOCALIBRATION,  $T_{\text{OPER}} \pm 5$   $^{\circ}\text{C}$  FROM  $T_{\text{ACAL}}$ )**

Range <sup>30</sup>	Resolution	Maximum burden voltage	Accuracy $\pm$ [ppm of reading + ppm of range]				
			24 hour $T_{\text{CAL}} \pm 1$ $^{\circ}\text{C}$ <sup>31</sup>	90 day $T_{\text{CAL}} \pm 5$ $^{\circ}\text{C}$	1 year $T_{\text{CAL}} \pm 5$ $^{\circ}\text{C}$	2 year $T_{\text{CAL}} \pm 5$ $^{\circ}\text{C}$	Temperature coefficient <sup>32</sup>
10 $\mu\text{A}$	1 pA	15 mV	30 + 30	75 + 30	75 + 30	75 + 30	0.15 + 0.1
100 $\mu\text{A}$	10 pA	15 mV	20 + 5	60 + 9	60 + 9	60 + 9	0.15 + 0.1
1 mA	100 pA	15 mV	30 + 5	60 + 9	60 + 9	60 + 9	0.15 + 0.1
10 mA	1 nA	20 mV	40 + 5	60 + 9	60 + 9	60 + 9	0.15 + 0.1
100 mA	10 nA	200 mV	50 + 18	150 + 30	150 + 30	150 + 30	0.15 + 0.1
1 A	100 nA	400 mV	150 + 50	400 + 50	400 + 50	400 + 50	0.15 + 0.1
3 A	1 $\mu\text{A}$	1300 mV	200 + 40	400 + 40	400 + 40	400 + 40	0.15 + 0.1

**ACCURACY**

Range <sup>38</sup>	Resolution	Maximum burden voltage	Accuracy $\pm$ [ppm of reading + ppm of range]				
			24 hour $T_{\text{CAL}} \pm 1$ $^{\circ}\text{C}$ <sup>39</sup>	90 day $T_{\text{CAL}} \pm 5$ $^{\circ}\text{C}$	1 year $T_{\text{CAL}} \pm 5$ $^{\circ}\text{C}$	2 year $T_{\text{CAL}} \pm 5$ $^{\circ}\text{C}$	Temperature coefficient <sup>40</sup>
10 $\mu\text{A}$	1 pA	15 mV	30 + 30	100 + 30	125 + 40	175 + 50	10 + 8
100 $\mu\text{A}$	10 pA	15 mV	20 + 5	75 + 12	100 + 15	150 + 20	10 + 3
1 mA	100 pA	15 mV	30 + 5	75 + 12	100 + 15	150 + 20	10 + 3
10 mA	1 nA	20 mV	40 + 5	75 + 12	100 + 15	150 + 20	10 + 3
100 mA	10 nA	200 mV	50 + 18	300 + 30	400 + 30	500 + 30	50 + 5
1 A	100 nA	400 mV	150 + 50	400 + 50	450 + 50	500 + 50	10 + 10
3 A	1 $\mu\text{A}$	1300 mV	200 + 40	400 + 40	450 + 40	500 + 40	10 + 10

<sup>30</sup> 20% overrange supported for all ranges except for 3 A and 10 A, which are 1% supported.

<sup>31</sup> Relative to calibration accuracy.

<sup>32</sup> Add per degree from  $T_{\text{CAL}} \pm 5$   $^{\circ}\text{C}$ .

Specifications and characteristics are subject to change without notice.

**RMS NOISE (ADDITIONAL PEAK NOISE UNCERTAINTY)<sup>33</sup>**

- Applies to ± ppm of range
- Peak noise uncertainty is included in dc specifications for PLC ≥ 1
- Add peak noise uncertainty to measurements for PLC < 1

Examples:

- 1 mA at 0.006 PLC: 9 (from Accuracy table) + 20 (additional peak noise uncertainty) = 29 ppm of range
- 1 mA at 1 PLC: 9 + 0 = 9 ppm of range

NPLC	Digits	10 µA	100 µA	1 mA	10 mA	100 mA	1 A	3 A
5	7½	0.20	0.14	0.09	0.1	0.3	0.3	0.23
1	7½	0.55	0.16	0.13	0.13	0.74	0.71	0.40
0.2 <sup>34</sup>	6½	3.0 (220)	0.40 (23)	0.30 (3.4)	0.31 (1.6)	2.41 (10)	2.40 (11)	0.89 (4.6)
0.2	6½	215.45 (480)	21.43 (26)	2.10 (3.8)	0.36 (1.8)	2.69 (9.8)	2.97 (10)	1.09 (5)
0.06	5½	228.95 (420)	22.84 (29)	2.31 (5.6)	0.57 (3.9)	3.33 (14)	3.46 (14)	1.74 (7.7)
0.006	4½	233.95 (550)	23.99 (42)	3.62 (20)	2.89 (20)	6.43 (30)	6.05 (31)	8.71 (51)
0.0005	3½	584.61 (2110)	62.60 (300)	28.73 (150)	28.88 (160)	34.88 (190)	35.04 (190)	91.84 (510)

**DC CURRENT CHARACTERISTICS**

Range	10 µA	100 µA	1 mA	10 mA	100 mA	1 A	3 A
<b>Effective internal shunt value<sup>35</sup></b>	1 kΩ	100 Ω	10 Ω	1 Ω	1 Ω	0.1 Ω	0.1 Ω
<b>Autozero off error:</b> For ±1 °C and ≤ 10 minutes add ±(8 ppm of reading + range error)	150 pA	1.5 nA	15 nA	150 nA	15 µA	150 µA	150 µA
<b>Overload recovery:</b> For each additional sustained amp beyond ±1.5 A, add the following initial ppm of range error until thermally settled after overload recovery	15500	1800	150	150	6500	200	—

**TEMPERATURE**

**4-WIRE RTD OR 3-WIRE RTD**

**Types:** 100 Ω platinum PT100, D100, F100, PT385, PT3916; or user-configurable 0 Ω to 10 kΩ

Type	Range	Resolution	Accuracy ± °C	
			2 year T <sub>CAL</sub> ± 5 °C	Temperature coefficient <sup>36</sup>
4-Wire RTD	-200 °C to 850 °C	0.01 °C	0.06 °C	0.003 °C / °C
3-Wire RTD <sup>37</sup>	-200 °C to 850 °C	0.01 °C	0.75 °C	0.003 °C / °C

<sup>33</sup> Noise values are based on 1000 readings with autozero on and AMPS terminal open. RMS noise is typical. Additional peak noise is guaranteed.

<sup>34</sup> With line sync on.

<sup>35</sup> Values are typical and guaranteed by design.

<sup>36</sup> Add per degree from T<sub>CAL</sub> ± 5 °C; specifications without autocalibration.

<sup>37</sup> For 3-wire RTD, accuracy is for < 0.1 Ω lead resistance mismatch for input HI and LO. Add 0.25 °C / 0.1 Ω of HI-LO lead resistance mismatch.

Specifications are subject to change without notice.

### THERMISTOR

Types: 2.252 kΩ, 5 kΩ, and 10 kΩ

Type	Range	Resolution	Accuracy ± °C	
			2 year T <sub>CAL</sub> ± 5 °C	Temperature coefficient <sup>40</sup>
Thermistor	-80 °C to +150 °C	0.01 °C	0.08 °C	0.002 °C/°C

### THERMOCOUPLE

Types: B, E, J, K, N, R, S, T

Type	Range	Resolution	Accuracy ± °C	
			2 year T <sub>CAL</sub> ± 5 °C <sup>38</sup> Simulated reference junction	Temperature coefficient <sup>40</sup>
B	350 °C to +1820 °C	0.1 °C	0.9 °C	0.03 °C/°C
E	-200 °C to +1000 °C	0.001 °C	0.4 °C	0.03 °C/°C
J	-200 °C to +760 °C	0.001 °C	0.4 °C	0.03 °C/°C
K	-200 °C to +1372 °C	0.001 °C	0.4 °C	0.03 °C/°C
N	-200 °C to +1300 °C	0.001 °C	0.4 °C	0.03 °C/°C
R	0 °C to +1768 °C	0.1 °C	0.9 °C	0.03 °C/°C
S	0 °C to +1768 °C	0.1 °C	0.9 °C	0.03 °C/°C
T	-100 °C to +400 °C	0.001 °C	0.4 °C	0.03 °C/°C

### CONTINUITY

Range <sup>39</sup>	Resolution	Test current	Open circuit voltage	Accuracy ±[ppm of reading + ppm of range]	
				2 year T <sub>CAL</sub> ±5 °C	Temperature coefficient <sup>40</sup>
1 kΩ	100 mΩ	1 mA	14.0 V	100 + 100	2.5 + 1

### CONTINUITY CHARACTERISTICS

Continuity high limit	User-selectable; default 10 Ω
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<sup>38</sup> Exclusive of cold-junction errors.

<sup>39</sup> Specifications exclude lead resistance.

<sup>40</sup> Add per degree from T<sub>CAL</sub> ±5 °C; specifications without autocalibration.

Specifications and characteristics are subject to change without notice.



## DIODE

Selectable bias current ( $\pm 5\%$ )	Voltage measure range <sup>10</sup>	Maximum voltage	Resolution	Accuracy $\pm$ [ppm of reading + ppm of range]			
				90 day $T_{CAL} \pm 5^\circ C$	1 year $T_{CAL} \pm 5^\circ C$	2 year $T_{CAL} \pm 5^\circ C$	Temperature coefficient <sup>50</sup>
10 $\mu A$ , 100 $\mu A$	10 V	12 V	1 $\mu V$	20 + 5	30 + 5	45 + 5	2.5 + 1
1 mA	10 V	12 V	1 $\mu V$	25 + 10	38 + 10	56 + 10	3 + 2
10 mA	10 V	5 V	1 $\mu V$	500 + 50	750 + 50	1125 + 50	50 + 10

## DIGITIZE VOLTAGE

### ACCURACY (INPUT IMPEDANCE AUTO)

Range <sup>41, 42</sup>	Resolution <sup>43</sup>	Input impedance <sup>44</sup>	Accuracy $\pm$ [ppm of reading + ppm of range]			
			90 day $T_{CAL} \pm 5^\circ C$	1 year $T_{CAL} \pm 5^\circ C$	2 year $T_{CAL} \pm 5^\circ C$	Temperature coefficient <sup>45</sup>
100 mV	1 $\mu V$	> 10 G $\Omega$ or 10 M $\Omega$ $\pm 1\%$	210 + 100	220 + 100	230 + 100	15 + 20
1 V	10 $\mu V$	> 10 G $\Omega$ or 10 M $\Omega$ $\pm 1\%$	110 + 75	120 + 75	130 + 75	15 + 20
10 V	0.1 mV	> 10 G $\Omega$ or 10 M $\Omega$ $\pm 1\%$	110 + 75	120 + 75	130 + 75	10 + 20
100 V <sup>46</sup>	1 mV	10 M $\Omega$ $\pm 1\%$	110 + 75	120 + 75	130 + 75	15 + 20
1000 V <sup>47</sup>	10 mV	10 M $\Omega$ $\pm 1\%$	110 + 75	120 + 75	130 + 75	10 + 20

<sup>41</sup> For dc coupling, 20% overrange for 100 mV to 100 V. For ac coupling, 500% overrange 100 mV to 100 V. 1% for 1000 V range dc and ac coupling.

<sup>42</sup> Accuracy with sample rate 1 k per second, aperture auto, and 100 reading buffer average.

<sup>43</sup> Power up default is 4½ digits.

<sup>44</sup> User-selectable.

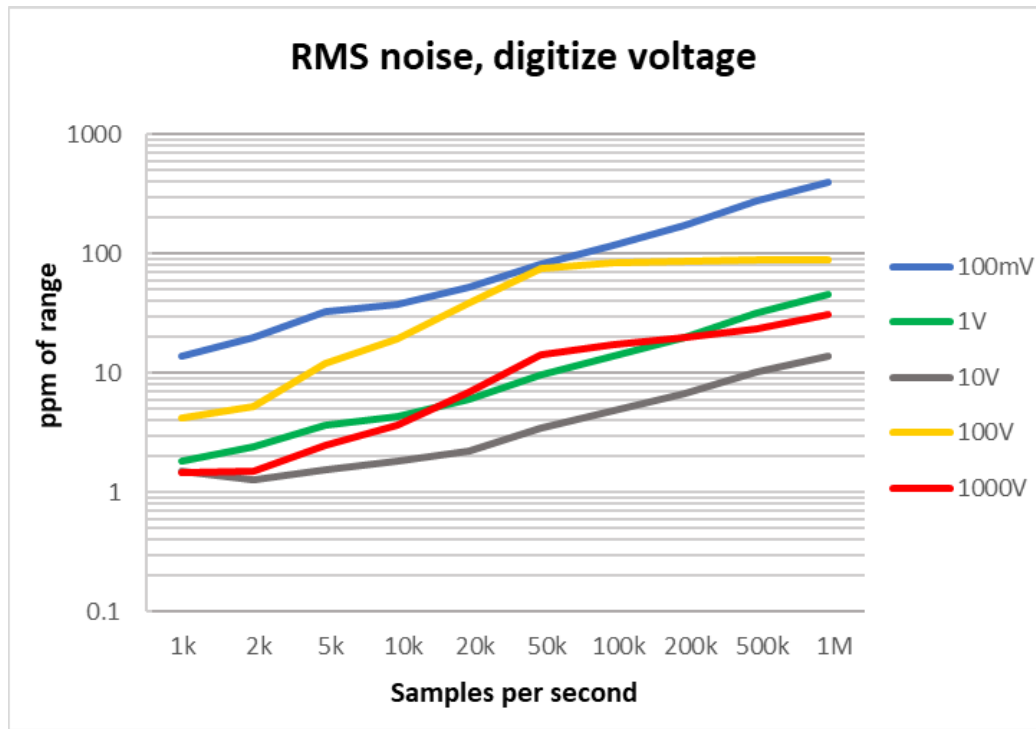
<sup>45</sup> Add per degree from  $T_{CAL} \pm 5\%$ .

<sup>46</sup> For 100 V range, input impedance auto and without  $A_{CAL}$ , add 100 ppm of range additional uncertainty and 15 ppm/°C additional uncertainty for "of range" temperature coefficient for operation outside of  $T_{CAL} \pm 5^\circ C$ .

<sup>47</sup> For signal levels greater than 500 V, add 0.02 ppm/V to the ppm of the readings specification for measurements exceeding 500 V.

Specifications are subject to change without notice.

**DC-COUPLED ADDITIONAL NOISE UNCERTAINTY, TYPICAL<sup>48</sup>**



**DIGITIZE CURRENT**

**DC ACCURACY<sup>49</sup>**

Range <sup>50</sup>	Resolution <sup>51</sup>	Burden voltage	Accuracy ± [ppm of reading + ppm of range]			
			90 day T <sub>CAL</sub> ±5 °C	1 year T <sub>CAL</sub> ±5 °C	2 year T <sub>CAL</sub> ±5 °C	Temperature coefficient <sup>52</sup>
10 µA	0.1 nA	15 mV	150 + 75	160 + 75	170 + 75	30 + 15
100 µA	1 nA	15 mV	150 + 75	160 + 75	170 + 75	30 + 15
1 mA	10 nA	15 mV	150 + 75	160 + 75	170 + 75	30 + 15
10 mA	100 nA	20 mV	150 + 75	160 + 75	170 + 75	30 + 15
100 mA	1 µA	200 mV	340 + 100	450 + 100	560 + 100	50 + 20
1 A	10 µA	400 mV	400 + 110	500 + 110	600 + 110	50 + 25
3 A	100 µA	1300 mV	650 + 150	900 + 150	900 + 150	50 + 25

<sup>48</sup> Specified with aperture Auto and 4-wire short on input terminals. For 100 V range, input impedance 10 MΩ, multiply by 2.5. For all ranges and sample rate > 1 k, add an additional 3× RMS noise uncertainty to ppm of range.

<sup>49</sup> Accuracy with sample rate 1 k per second, aperture auto, and 100 reading buffer average.

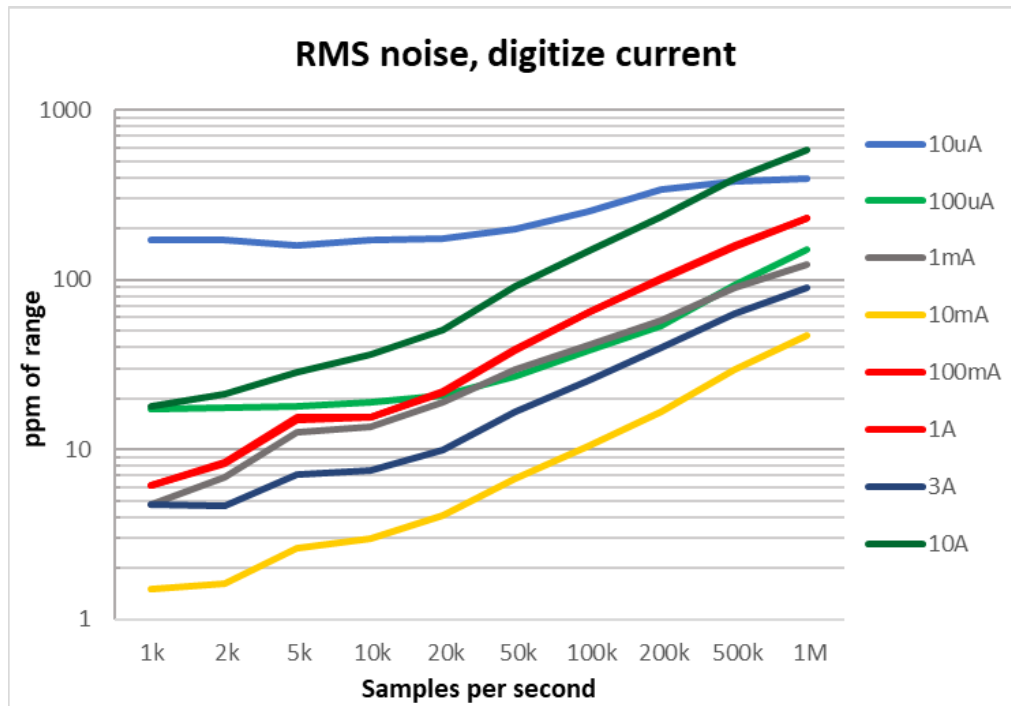
<sup>50</sup> 20% overrange on all ranges except 3.3% for 3 A and 10 A ranges.

<sup>51</sup> Power up default is 4½ digits.

<sup>52</sup> Add per degree from T<sub>CAL</sub> ±5 °C.

Specifications and characteristics are subject to change without notice.

**ADDITIONAL NOISE UNCERTAINTY, TYPICAL<sup>53</sup>**



**DIGITIZER CHARACTERISTICS**

Maximum resolution	18 bits
Measurement input coupling	Voltage only, dc or ac
Sampling rate <sup>54</sup>	Programmable 1 k through 1 MS per second
Volatile sample memory with timestamp	27.5 million
Minimum sampling time	1 μs
Timestamp resolution	1 ns with standard or full buffer style 1 μs with compact buffer style
Timestamp accuracy	With standard or full buffer style, 20 ns between adjacent readings, with total buffer time < 2 s With compact buffer style, 2 μs adjacent readings, with total buffer time < 2 s
Maximum sample memory	8 million

<sup>53</sup> Specified with aperture Auto and open input terminals. For all ranges and for ≥1 k sample rate, add an additional 3 × RMS noise uncertainty to ppm of range.

<sup>54</sup> Sample rate is not continuously adjustable. For valid discrete settings, see the *Model DMM7512 Reference Manual*.

Specifications are subject to change without notice.

**TYPICAL READING RATES, 60 Hz (50 Hz) OPERATION<sup>55, 56, 57, 58</sup>**

NPLC	Digits	Functions: dc voltage (10 V) 2-wire ohms ( $\leq 10\text{ k}\Omega$ ), dc current (1 mA)		Functions: 4-wire ohms ( $\leq 1\text{ k}\Omega$ ) 4-wire / 3-wire RTD		Functions: Thermistor		Functions: Dry circuit ( $\leq 1\text{ k}\Omega$ )	
		Measure- ments into buffer	Measure- ments into computer	Measure- ments into buffer	Measure- ments into computer	Measure- ments into buffer	Measure- ments into computer	Measure- ments into buffer	Measure- ments into computer
1	7½	59.8 (49.8)	58 (48)	29 (24)	28 (24)	57 (48)	57 (48)	27 (23)	26 (22)
0.2	6½	295 (240)	250 (210)	128 (109)	119 (100)	230 (200)	230 (200)	100 (89)	96 (85)
0.06	5½	965 (810)	950 (800)	310 (280)	315 (280)	900 (750)	900 (750)	190 (180)	190 (180)
0.006	4½	7500 (6700)	7300 (6500)	750 (730)	740 (720)	6800 (6000)	6800 (6000)	295 (290)	295 (290)
0.0005	3½	26000 (26000)	24000 (24000)	860 (860)	860 (860)	18000 (18000)	18000 (18000)	310 (310)	310 (310)

**DIGITIZE, TYPICAL**

Sampling rates (samples per second)	Digits	Resolution	Measurements into computer <sup>58</sup>
10 kS/s	5½	18	9700
20 kS/s	4½	16	19000
50 kS/s	4½	16	44400
100 kS/s	4½	15	80000
1 MS/s	3½	12	108000

**SYSTEM PERFORMANCE, TYPICAL**

- Mode: 3½ digit, autozero off, 0.0005 PLC, excludes measurement time
- Time includes function change from dc voltage or 2-wire ohms to listed function

Function	Function change (ms)	Range change (ms)
DC voltage or 2-wire ohms ( $< 10\text{ k}\Omega$ )	6	1.3
4-wire ohms ( $< 10\text{ k}\Omega$ )	7	1.3
DC current	7	1.3
Digitize voltage or current	7	1.3

<sup>55</sup> Reading speeds for autozero off, fixed range, autodelay off. Offset compensation off and open lead detector off where applicable.

<sup>56</sup> Buffer measurements: For  $< 0.2$  PLC, multisample, single buffer transfer binary reading only.

<sup>57</sup> PC measurements: For 1 and 0.2 PLC single reading and single transfer to computer (USB).

<sup>58</sup> Reading rates using factory default operating conditions and autorange off, autodelay off. Speeds include measurement and data transfer out of the USB.  $\geq 1000$  readings with 4-byte binary transfer over USB.

Specifications and characteristics are subject to change without notice.

**RANGES FOR FUNCTION CHANGE TIMES**

Function change times apply to the ranges listed in the table below.

Function	Range
DC voltage	10 V
2-wire or 4-wire ohms	1 k $\Omega$
DC current	1 mA
Thermocouple	Use dc voltage rates
Thermistor	Use 2-wire ohms rates

Buffer transfer speed (binary)	Measurements into computer (per second)	
	USB	LAN
Average for 1000 readings	280000	270000
Average for 1000 readings with timestamp	170000	140000

**TRIGGERING**

Time base accuracy	25 ppm
Trigger source	Analog dc voltage, dc current, or any system trigger
Trigger coupling	dc
Input trigger latency <sup>59, 60, 61</sup>	< 225 ns
Input trigger jitter	< 50 ns
Sample period jitter	< 1 ns

**DMM TRIGGERS**

EXT TRIG IN and OUT	0 V to 5 V logic signal input and output, TTL-compatible
EXT trigger latency (IN and OUT)	< 400 ns
EXT trigger latency (IN or OUT)	< 200 ns (guaranteed by design)

<sup>59</sup> Guaranteed by design; for digital I/O only.

<sup>60</sup> Stimulus command required to meet specifications.

<sup>61</sup> If using trigger model, add 200 ns uncertainty.

**ANALOG TRIGGERING<sup>62</sup>**

**ANALOG LEVEL, EDGE, OR WINDOW TRIGGER TYPES<sup>63</sup>**

Trigger characteristics	Voltage input	Current input
Input range	100 mV to 1000 V	10 µA to 10 A
Resolution	0.05%	0.05%
Basic accuracy ( $T_{ACAL} \pm 5\text{ }^{\circ}\text{C}$ ) <sup>64, 65</sup>	1%	1%

**ANALOG TRIGGER LATENCIES**

	Digital I/O	External
Positive logic	800 ns + 40 ns jitter	930 ns + 40 ns jitter
Negative logic	800 ns + 40 ns jitter	840 ns + 40 ns jitter

**WINDOW FILTER AND MEMORY (BUFFER)**

Window filter size	0 to 10% of reading, where 0 averages all readings
Memory	Up to 27.5 million timestamped readings with the compact buffer style, with additional memory available using an external USB flash drive
Maximum Internal memory (buffer)	27.5 million readings with the compact buffer style (6½-digit without formatting); 11 million readings with the standard or full buffer styles

<sup>62</sup> For dc or ac coupled, the trigger level can be set up to 100% of measure range.

<sup>63</sup> Rising or falling edge triggering supported. Window trigger requires setting two independent levels.

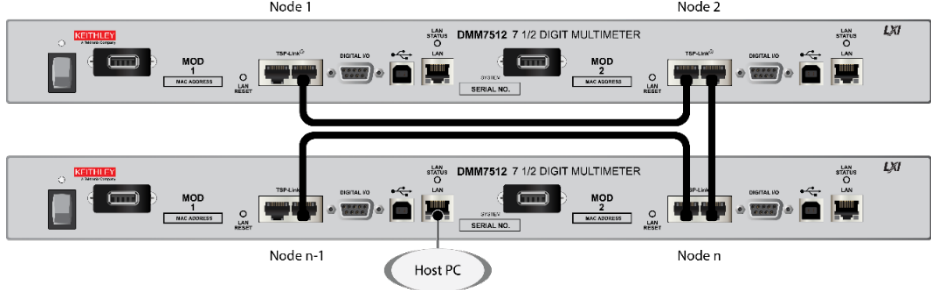
<sup>64</sup> Trigger event occurs after the threshold crossing at a time determined by total trigger latencies.

<sup>65</sup> Accuracy specifications require user  $A_{CAL}$  and are verified with level trigger amplitude set to 50% of range with a 100 Hz sine wave at 100% full scale of range. High frequency rejection is off. NPLC 0.0005 (dc voltage/dc current) or aperture 1 µs for digitize voltage or digitize current. Specified for fixed range, autozero off. For digitized dc voltage ac coupled, add 0.5%. For dc current and digitized dc current 3 A or 10 A ranges, add an additional 2%.

Specifications and characteristics are subject to change without notice.

## GENERAL INSTRUMENT SPECIFICATIONS

<b>Input protection</b>	1010 V dc all ranges and functions on HI and LO terminals; 350 V all ranges and functions on sense HI, sense LO terminals; 250 V rated current input terminal; fused 3 A range; current input terminals protected to 1 kV
<b>3 A input fuse protection</b>	3.5 A, 1 kV fast blow type; Keithley part number DMM7510-FUSE-3A
<b>Common mode isolation</b>	500 V dc or ac $V_{PEAK}$ LO to chassis All terminals > 10 G $\Omega$ , < 1000 pF any terminal to chassis
<b>Power line</b>	Universal input, 100 V to 240 V
<b>Line frequency</b>	50 Hz or 60 Hz, automatically sensed at power-up
<b>Power consumption</b>	165 VA
<b>Operating environment</b>	Specified for 0 °C to 50 °C, 70% relative humidity up to 35 °C; derate 3% relative humidity per °C, 35 °C to 50 °C
<b>Storage environment</b>	-25 °C to 65 °C
<b>Environment</b>	For indoor use only
<b>Altitude</b>	Maximum 2000 m (6562 ft) above sea level
<b>Pollution degree</b>	2
<b>Real time clock</b>	Lithium battery backup (3+ years battery life)
<b>EMC</b>	Conforms to European Union EMC Directive
<b>Safety</b>	NRTL listed to UL61010-1 and CSA C22.2 No 61010-1; conforms with European Union Low Voltage Directive
<b>Vibration</b>	MIL-PRF-28800F Class 3, Random
<b>Warm-up</b>	4 hours to rated accuracy
<b>Input signal connections</b>	Rear safety banana jacks
<b>Cooling</b>	Forced air, side intake, and rear exhaust
<b>Dimensions</b>	<b>Rack Mount:</b> 44 mm high × 483 mm wide × 696 mm deep (1.7 in. × 19 in. × 27.41 in.)
<b>Shipping weight</b>	11.3 kg (25.0 lb.)

<b>Digital I/O</b>	<b>Connector</b>	9-pin female D
	<b>5 V power supply pin</b>	Limited to 500 mA at > 4 V (solid-state fuse protected)
	<b>Lines</b>	Six input/output, user-defined, for digital I/O or triggering
	<b>Input signal levels</b>	0.7 V (maximum logic low) 3.7 V (minimum logic high)
	<b>Input voltage limits</b>	-0.25 V (absolute minimum) +5.25 V (absolute maximum)
	<b>Maximum source current</b>	+2.0 mA at > 2.7 V (per pin)
	<b>Maximum sink current</b>	-50 mA at 0.7 V (per pin, solid-state fuse protected)
	<b>Handler</b>	User-defined start of test, end of test, four category bits
<b>Math functions</b>	Rel, dB, Limit Test, Percentage, 1/x, and mX + b	
<b>Remote interface</b>	LAN: RJ-45 connector, 10/100BT; Virtual Front Panel USB device (front panel, type B): 2.0 full speed, USBTMC compliant USB host (front panel, type A): USB 2.0, support for flash drives, FAT 32	
<b>LXI compliance</b>	LXI version 1.4 Core 2011	
<b>Language</b>	Embedded Test Script Processor (TSP) accessible from any host interface; responds to high-speed test scripts comprised of remote commands and statements (for example, branching, looping, math); able to execute high-speed test scripts stored in memory without host intervention; also, SCPI (default command set)	
<b>Expansion interface</b>	<p>The TSP-Link expansion interface allows TSP-enabled instruments to trigger and communicate with each other. See the figure below.</p>  <p>The DMM7512 has four TSP-Link connectors (two on each module) to make it easier to connect instruments in a sequence.</p> <ul style="list-style-type: none"> <li>Once instruments are interconnected through the TSP-Link expansion interface, a computer can access all the resources of each instrument through the host interface of any TSP-Link instrument.</li> <li>A maximum of 32 TSP-Link nodes can be interconnected. Each module uses one TSP-Link node.</li> </ul>	
<b>IP configuration</b>	Static or DHCP (manual or automatic)	